Improving the Resilience of African Countries to Food Shock

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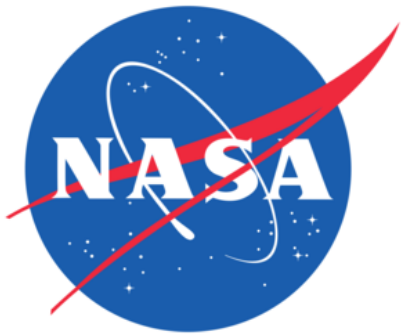

Outline

Global Food Trade Network

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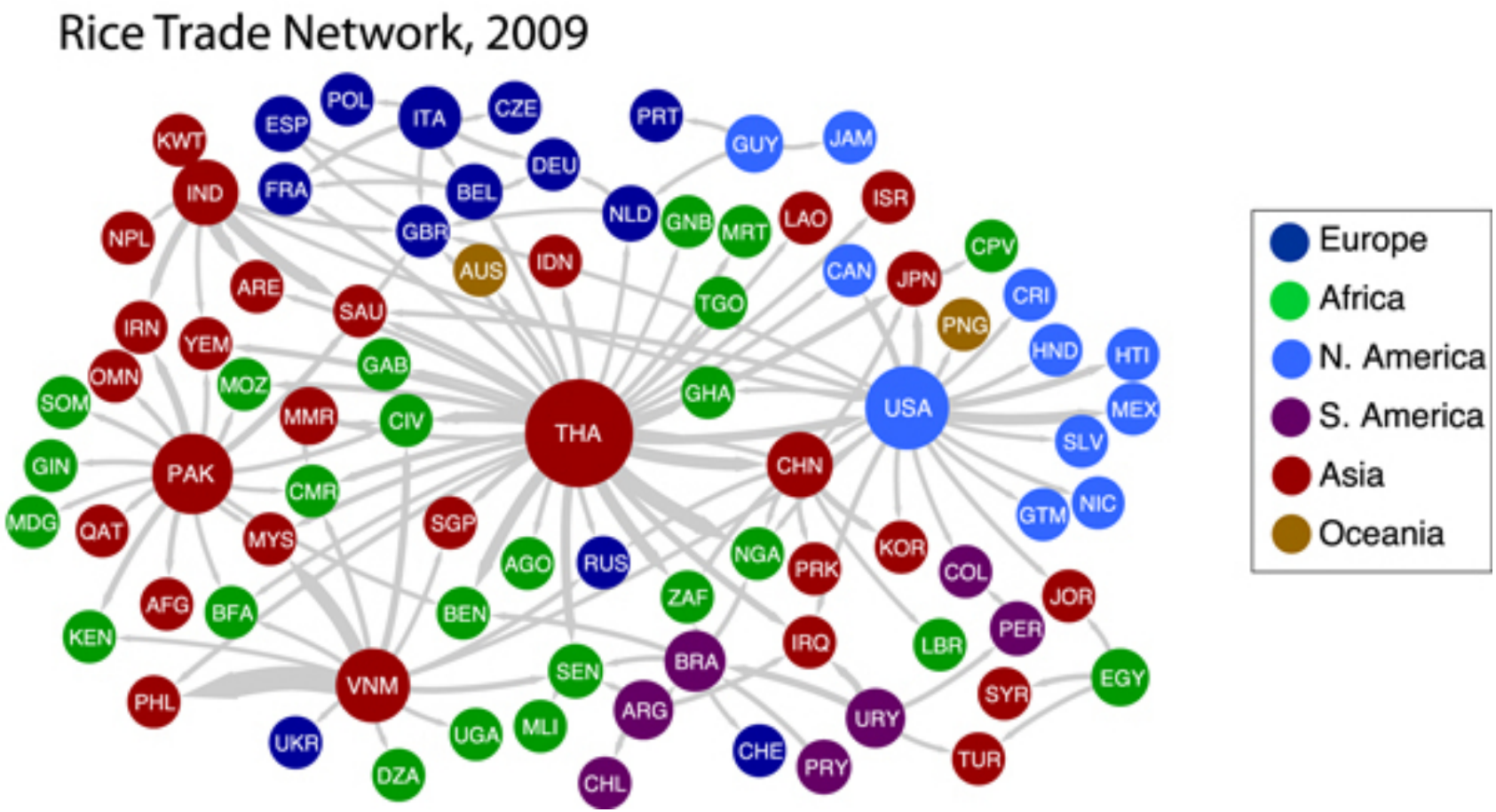

Figure: By Puma M J, Bose S, Young Chon S and Cook B I 2015 Assessing the evolving fragility of the global food system Environ. Res.

Systemic Risk in the Global Food System

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Figure: Bank run on Northern Rock in 2007. By Dominic Alves from Brighton, England Northern Rock Queue, CC By 2.0.

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Figure: A food protest in Mexico in 2008. By The Road to the Horizon CC BY-NC-ND 3.0.

Lessons from Complex Systems Theory

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- Generic indicators of systemic risk exist.

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- Network structure affects systemic risk.

Connectivity and Homogeneity

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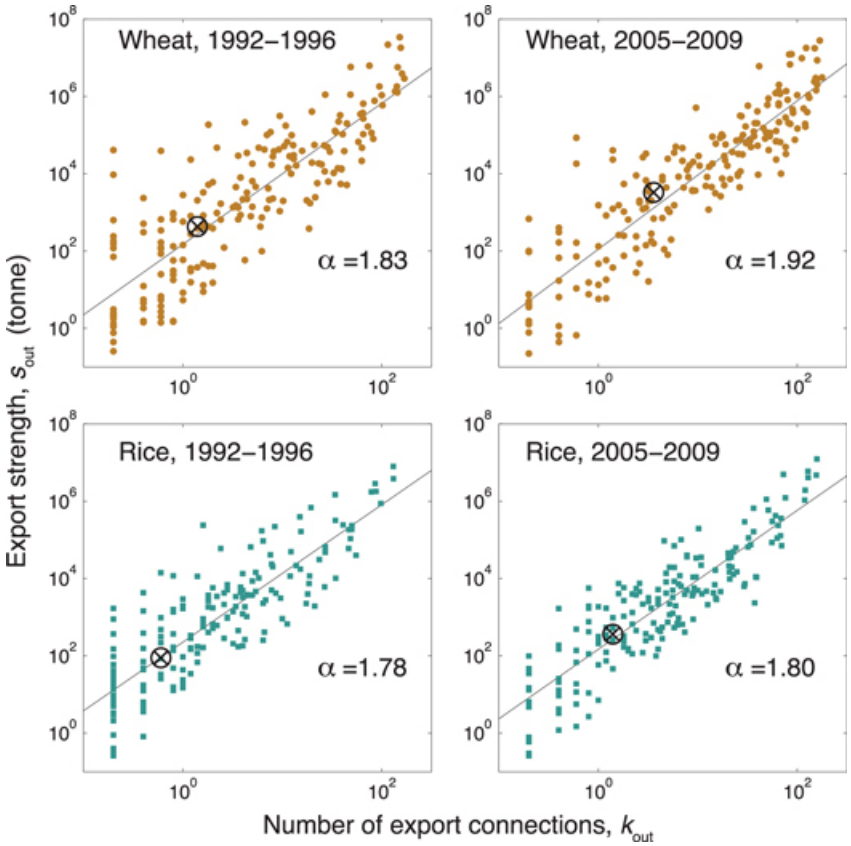


Figure: By Puma M J, Bose S, Young Chon S and Cook B I 2015 Assessing the evolving fragility of the global food system Environ. Res. Lett. 10 24007 IOPscience. CC By 3.0.

Short Term Shocks

Figure: By National Oceanic and Atmospheric Administration. Public domain, via Wikimedia Commons.

Global Food Trade Intensification

Table 1. Complex-network metrics for the global wheat and rice trade networks for 1992–1996 and 2005–2009. Each value is an average value for the respective time period (i.e., 1992–1996 or 2005–2009). (Note: mmt stands for million metric tonnes.)

		Wheat		Rice	
Network metric	Symbol	1992–1996	2005–2009	1992–1996	2005–2009
Global trade, mmt yr^{-1}	G_{total}	116	157	24.6	42.7
Number of links, -	L	3925	6415	1671	2731

Figure: By Puma M J, Bose S, Young Chon S and Cook B I 2015 Assessing the evolving fragility of the global food system Environ. Res. Lett. 10 24007 IOPscience. CC By 3.0.

Changing Agricultural Patterns

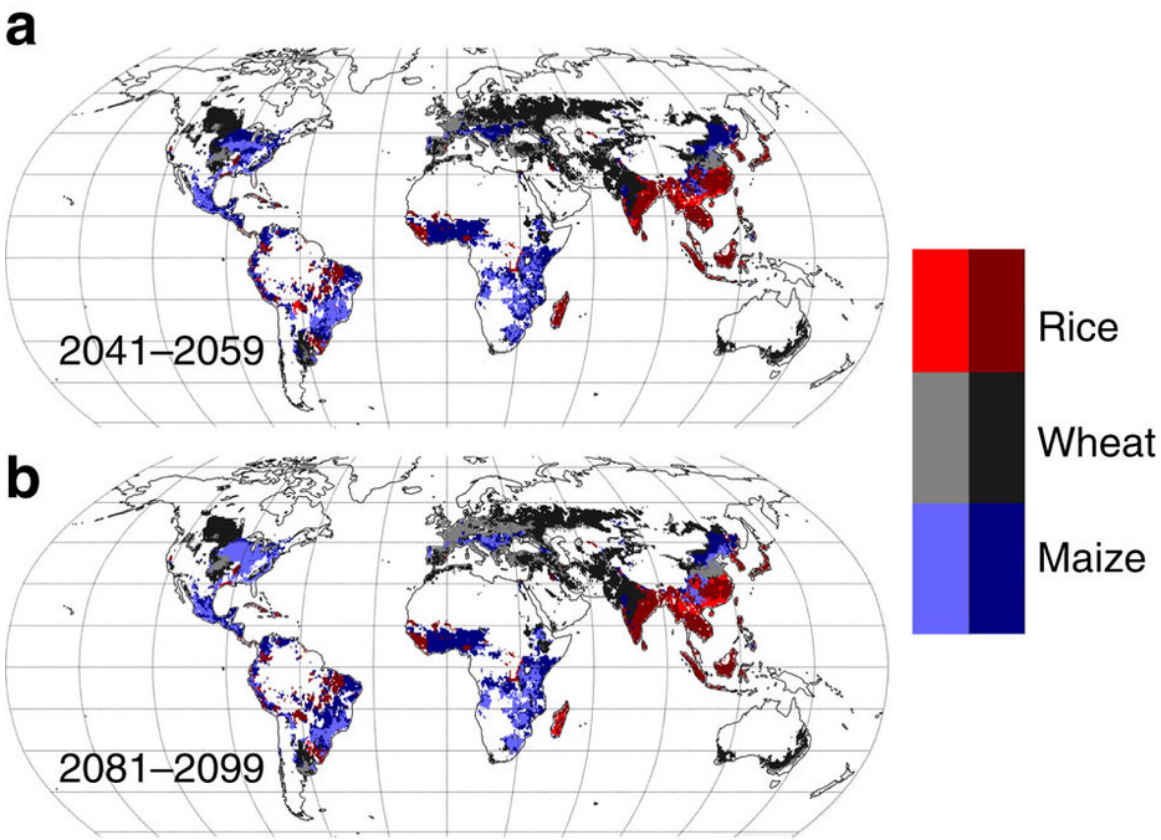
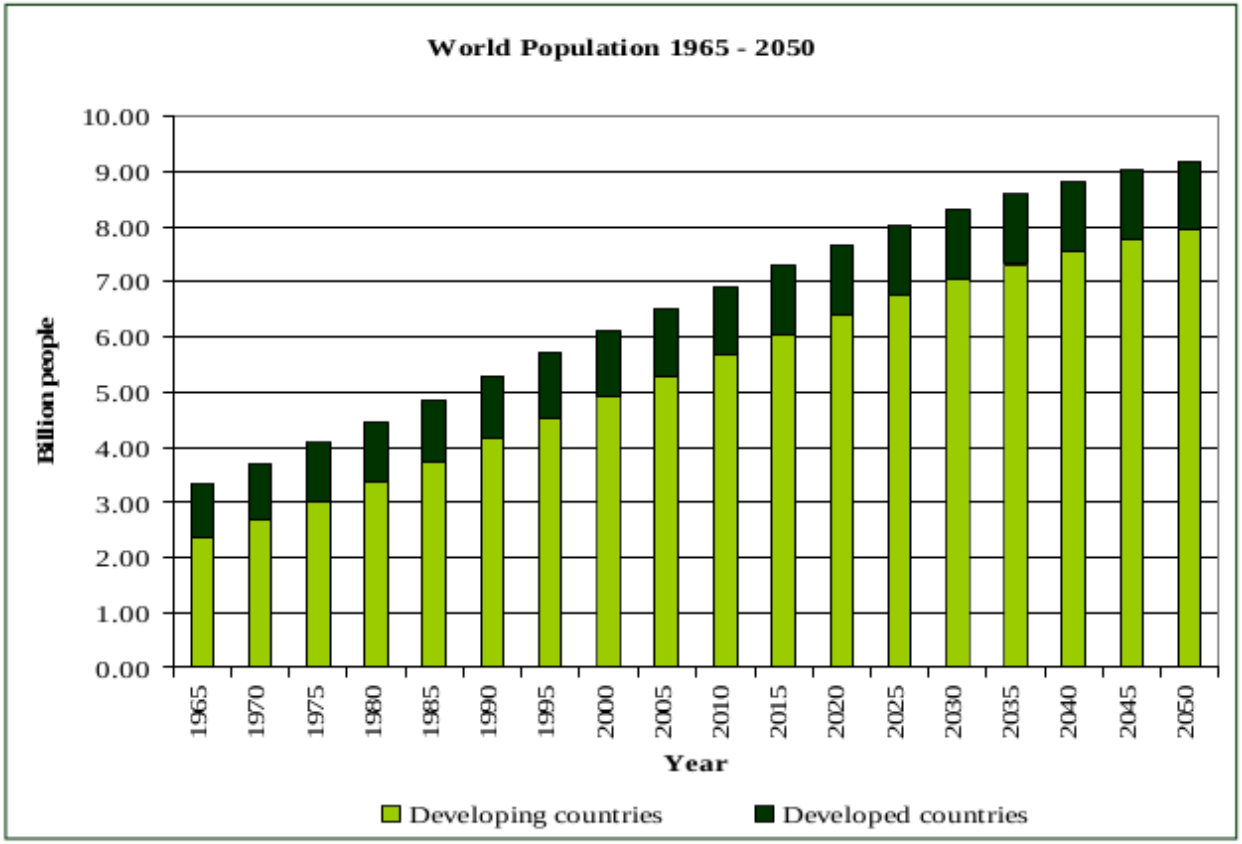


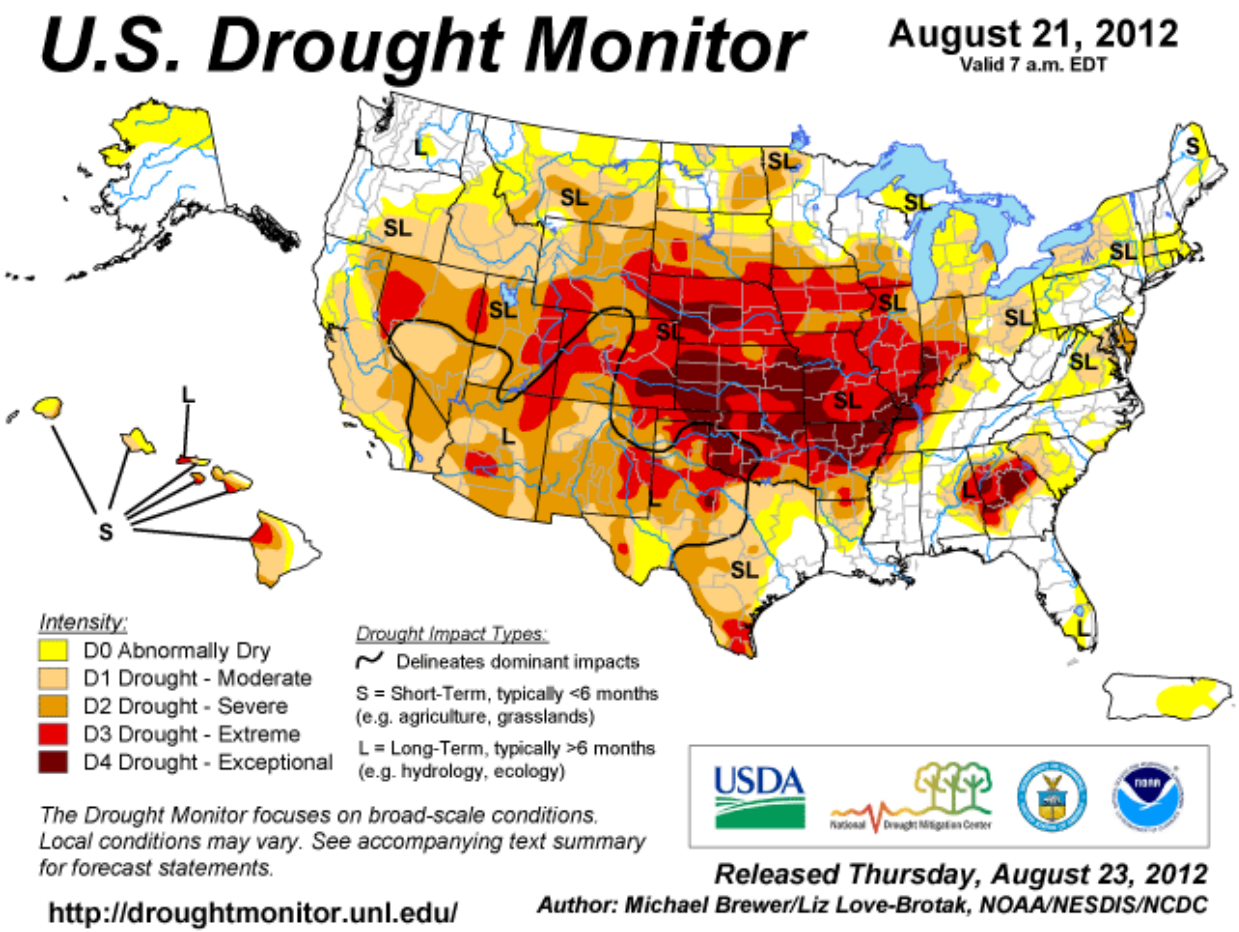
Figure: By Pugh T.A.M., Muller C., Elliot J., Deryng D., Folberth C., Olin S., Schmid E. and Arneth A. 2016 Climate analogues suggest limited potential for intensification of production on current croplands

Increasing Population



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007)

2012-2013 North American Drought



2010–2011 Global Food Crisis

Figure: Protesters celebrate in Tahrir Square on Feburary 11, 2011. By Jonathan Rashad (Flickr) CC By 2.0 via Wikimedia Commons.

Crop Diseases

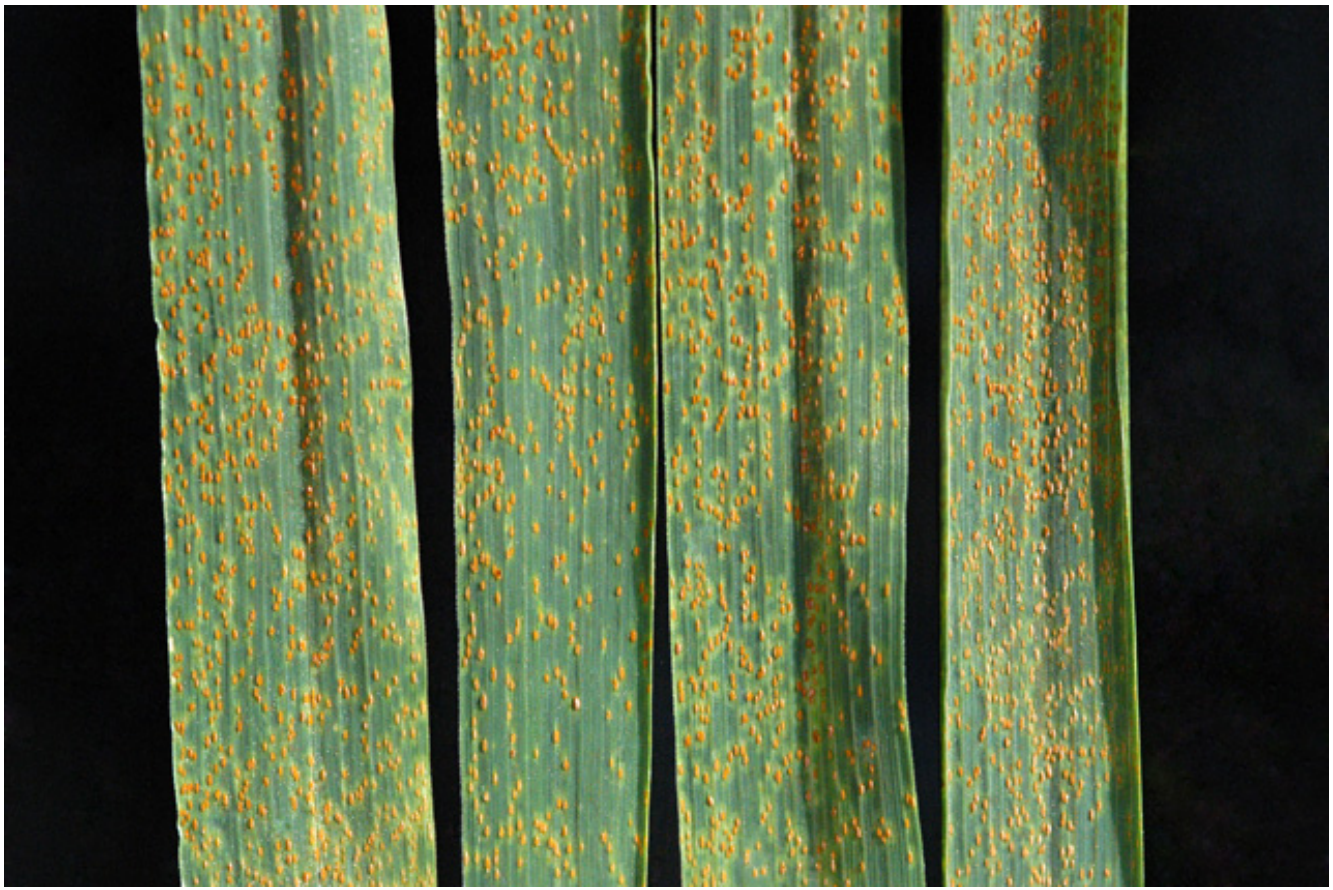


Figure: Close up of wheat leaf rust. Photo by James Kolmer. Agricultural Research Service, USDA Image Number D519-1

Marchand Model

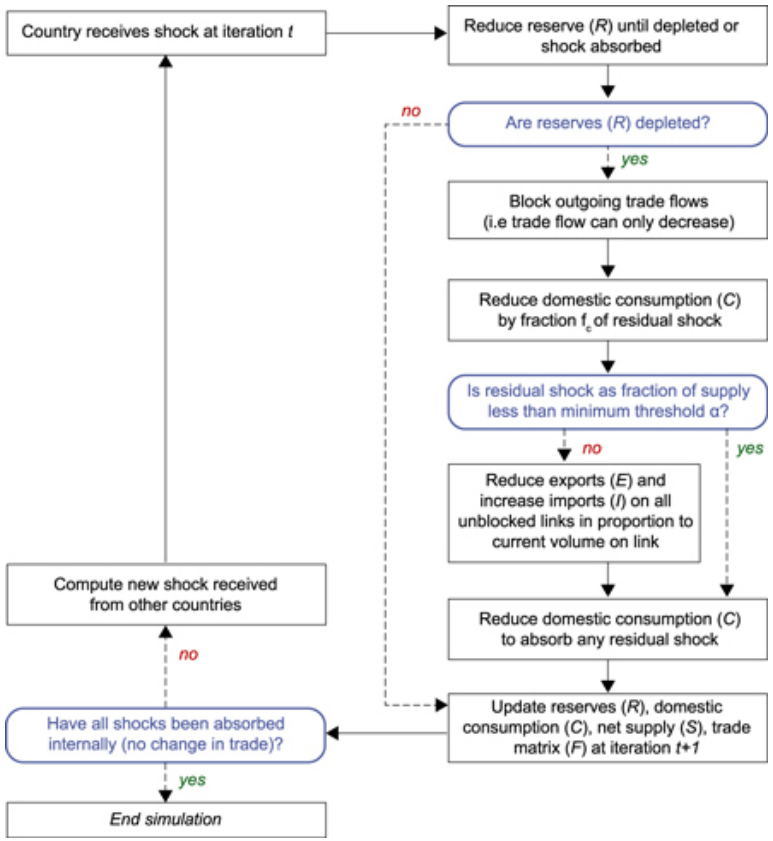


Figure: Figure 1 from Reserves and trade jointly determine exposure to food supply shocks Philippe Marchand et al 2016 Environ. Res. Lett. 11 095009 doi:10.1088/1748-9326/11/9/095009

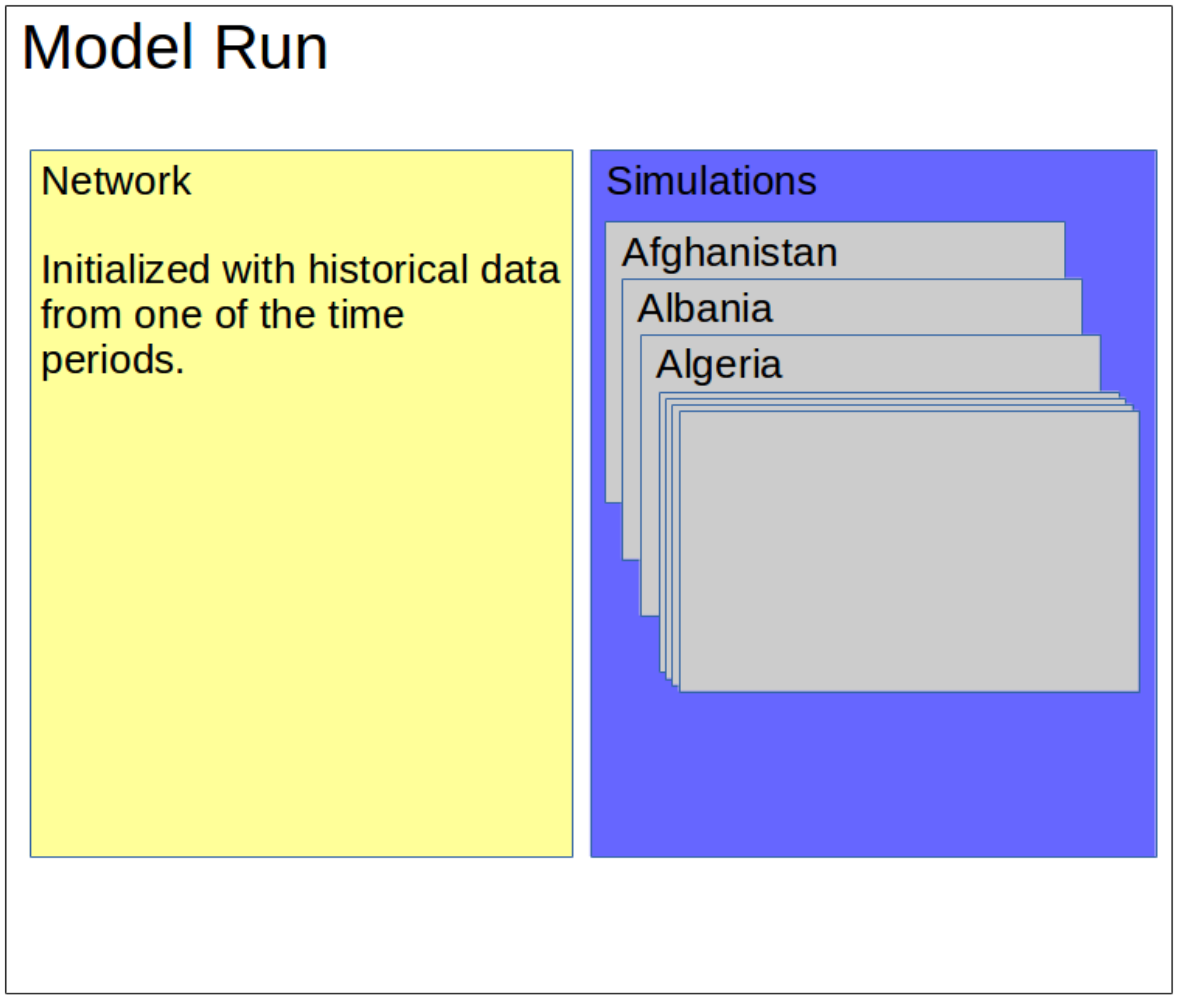
Time Periods

- 1996–2000 Food Trade Network
- 2006–2010 Food Trade Network

Model Parameters

- *Fraction of production* $f_p = 0.20$
- *Fraction of reserves* $f_r = 0.5$
- *Fraction of consumption* $f_c = 0.01$

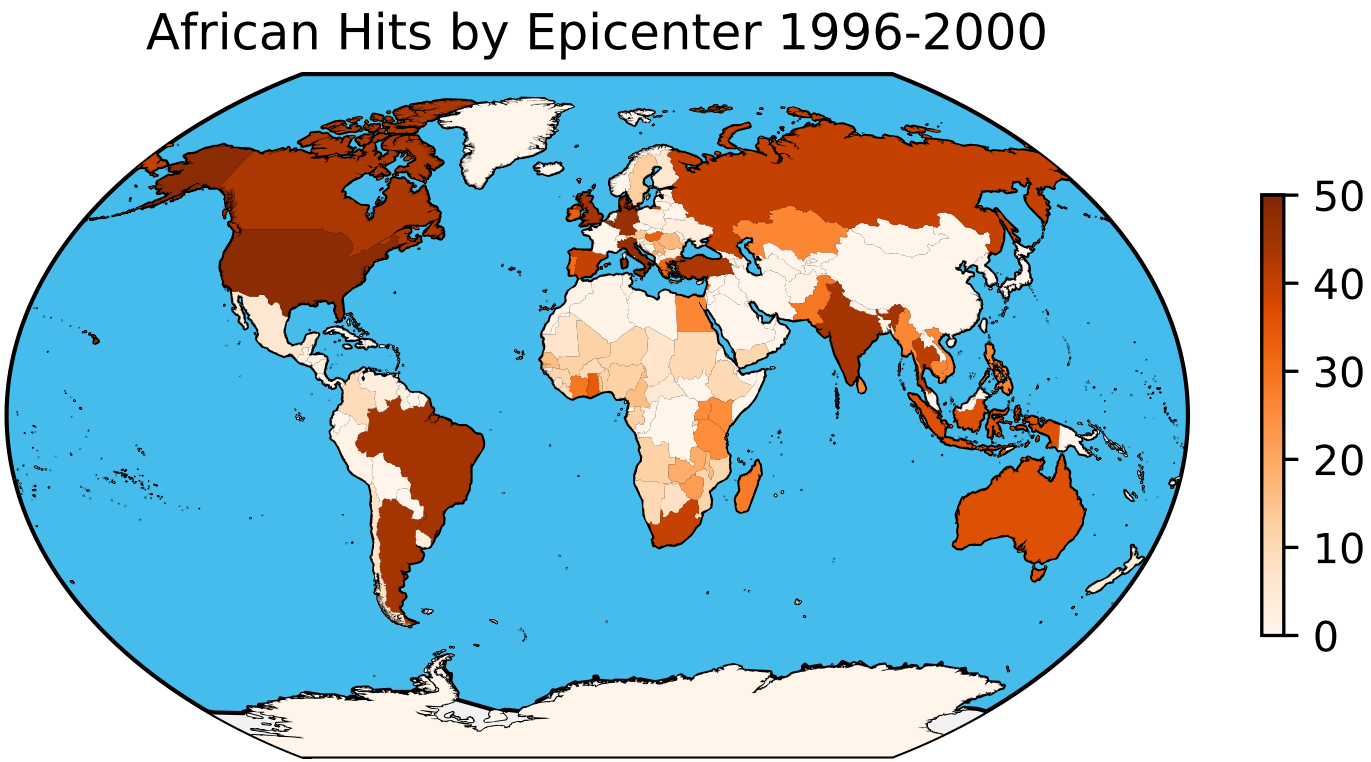
Model Run


Model Run
Network
Initialized with historical data from one of the time periods.
Simulations
Afghanistan
Albania
Algeria

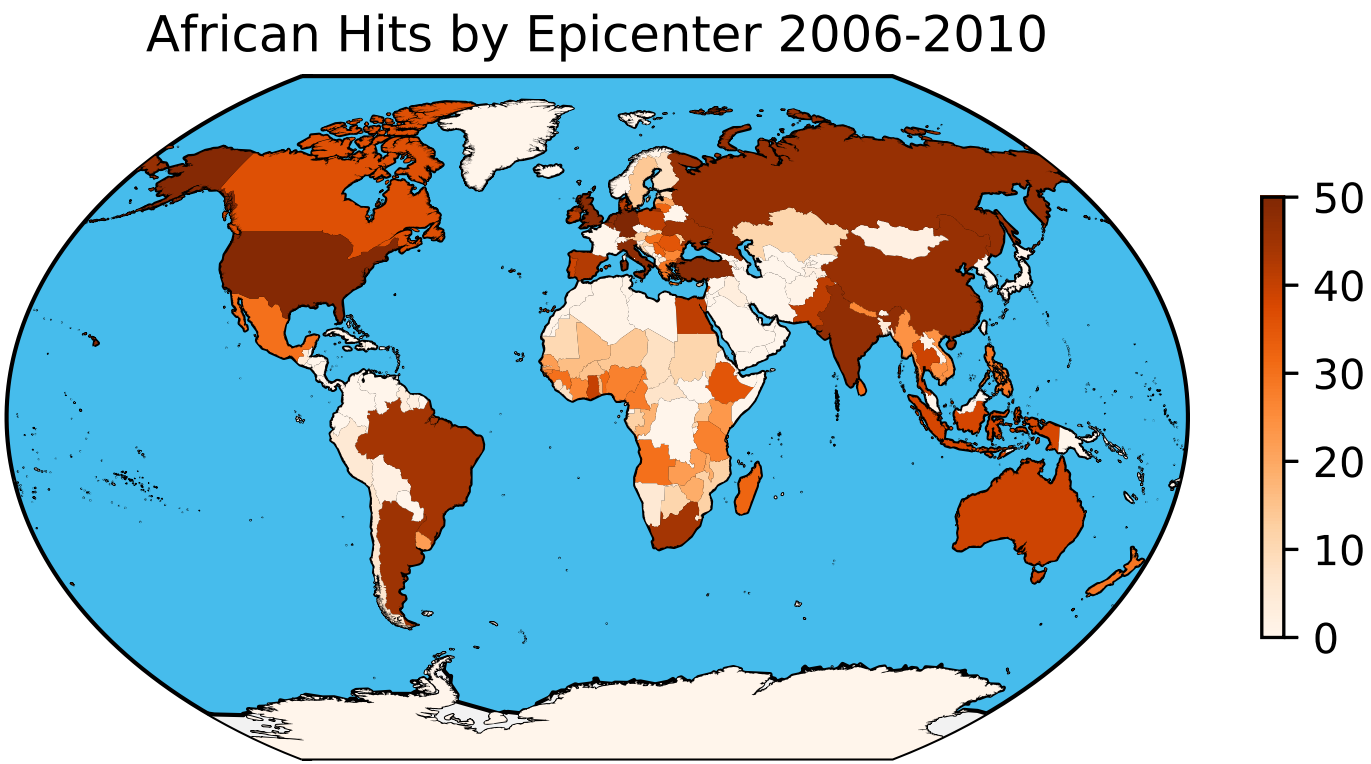
Supply Hits

	1996–2000	2006–2010
N_h	48.00	61.6
N_h^A	35.8	48.8

African Supply Hits



African Supply Hits



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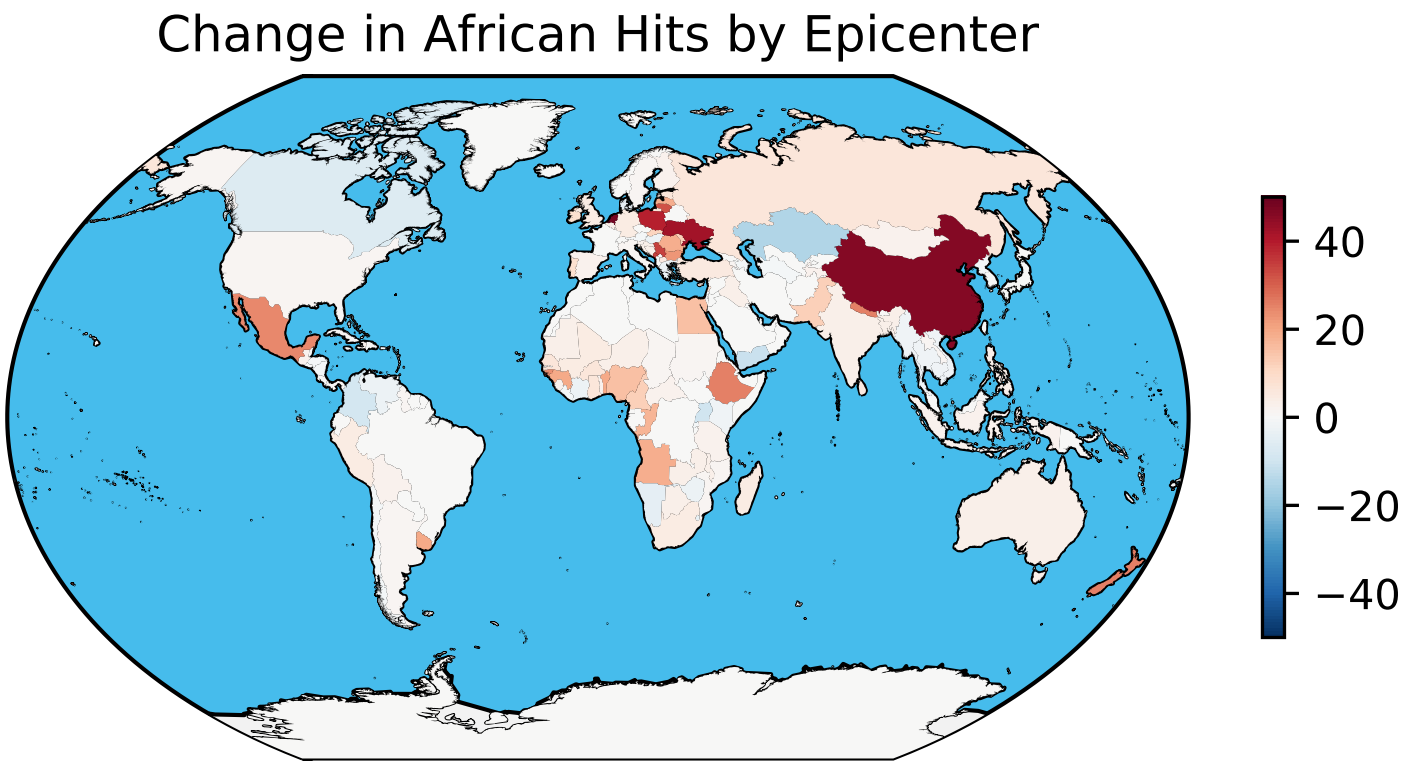
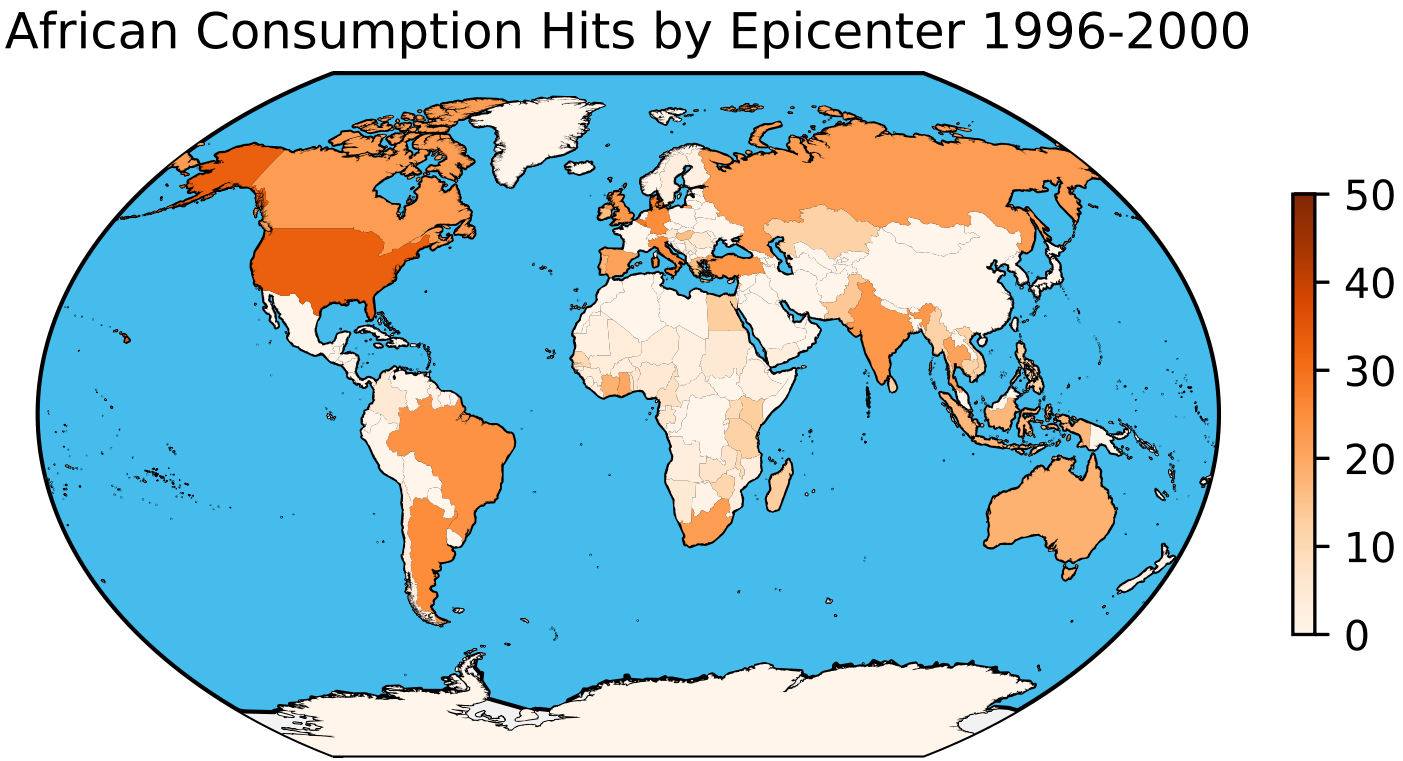


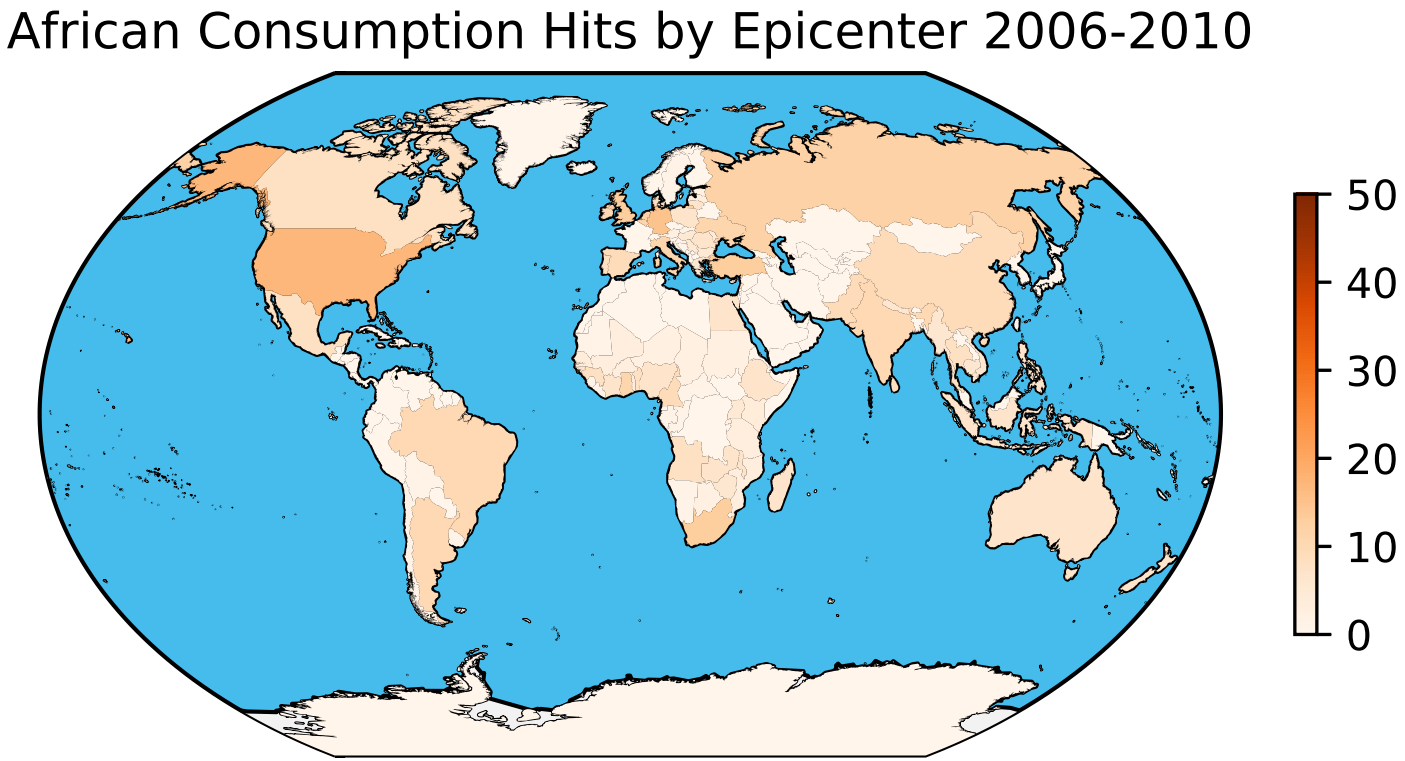
Consumption Hits

	1996–2000	2006–2010
N_{hc}	10.0	8.7
N_{hc}^{A}	17.2	10.7

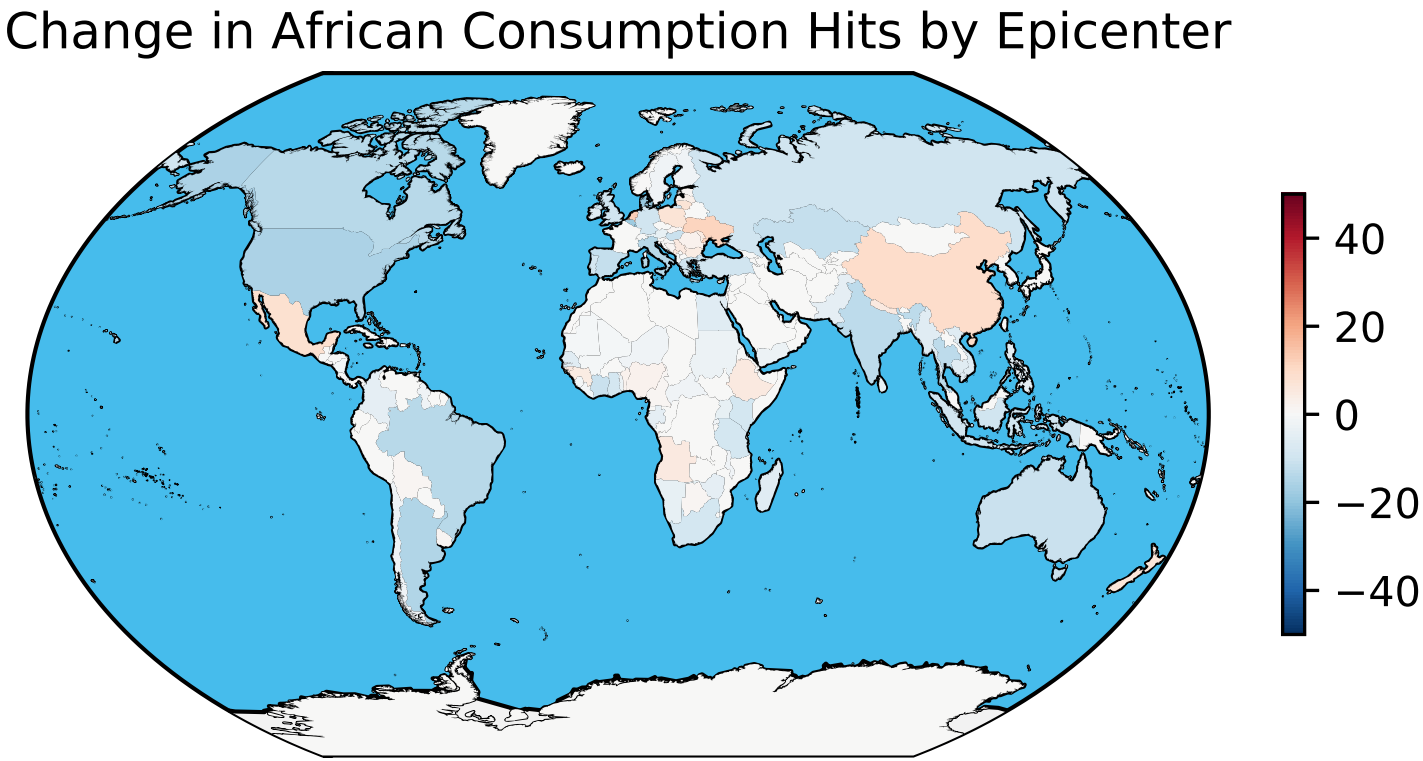
African Consumption Hits



African Consumption Hits



African Consumption Hits



Trade Volumes

G	A	A_i	$A/G\%$	$A_i/A\%$

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1996–2000	933.5	138.8	7.5	14.9%	5.41%

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	G	A	A_i	$A/G\%$	$A_i/A\%$
1996–2000	933.5	138.8	7.5	14.9%	5.41%
2006–2010	1,200.0	209.8	8.5	17.5%	4.1%
Δ	266.5	71.0	1.0	2.6%	-1.4%
$\Delta\%$	28.5%	51.2%	13.2%		

Supply Hits (Part 2)

	1996–2000	2006–2010
N_h^A	35.8	48.8
$N_h'^A$	26.4	39.1
Δ	-9.4	-9.7
$\Delta\%$	-26.3%	-19.9%

Consumption Hits (Part 2)

	1996–2000	2006–2010
N_{hc}^{A}	17.2	10.7
$N_{hc}^{\prime A}$	13.3	9.3
Δ	-3.9	-1.4
$\Delta\%$	-22.4%	-13.5%

Summary

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- Intensifying dependence on extra-African cereals imports.

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- Declining intra-African trade.

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- Declining intra-African trade.
- Intra-African trade is still critical to African food security.